ARIZONA GRAVEL PIT ROAD
Six Companies Aggregate Facilities and Railroad District
6 to 8 miles northeast of Boulder City
Boulder City vicinity
Clark County
Nevada

HAER NV-42
NV-42

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC WEST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
1111 Jackson Street, Suite 700
Oakland, CA 94607

HISTORIC AMERICAN ENGINEERING RECORD
ARIZONA GRAVEL PIT ROAD
HAER No. NV-42

Location:	6 to 8 miles northeast of Boulder City, Nevada Clark County, Nevada USGS Quad – Boulder Beach, Nevada Zone 11, 700218E 3991556N
Date of Construction:	Original construction date unknown, improved in 1931 - 1932
Engineer:	Unknown
Builder:	Original builder unknown Improved by Six Companies, Inc. (Kaiser Paving Company, Ltd.)
Present Owner:	Bureau of Reclamation, Department of the Interior
Historic Use:	Regional transportation route, access corridor between Hoover Dam aggregate pit and aggregate classification plant
Present Use:	None – use of road discontinued in 1935
Significance:	The Arizona Gravel Pit Road located in Boulder Basin served as an integral link between the source of aggregate used to construct Hoover Dam and the classification plant where that aggregate was processed. The improved roadway saw use from January 1932 to November 1934, when the aggregate pit and plant were closed down. The road was an integral element of the aggregate procurement and processing system, which in turn was instrumental to the successful and timely completion of Hoover Dam.
Report Prepared By:	Ron Reno, Ph.D and Charles Zeier Zeier & Associates, LLC 119 Tradewind Street Clinton, Tennessee 37716 and David Choate, David Conlin, Ph.D, and Daniel Lenihan National Park Service, Submerged Resources Center P.O. Box 728 Santa Fe, New Mexico 87505
Report Date:	July 2009

I. PHYSICAL DESCRIPTION

Hoover Dam is a concrete arch-gravity dam in the Black Canyon of the Colorado River, on the border between the Arizona and Nevada. Construction of the dam required the placement of 4.36 million cubic yards of concrete, all of which was mixed on site at one of two batch plants. Concrete consists of four ingredients – Portland cement, sand, crushed rock aggregate, and water. Portland cement was shipped in via rail, while water was taken from the Colorado River. Aggregate was mined locally from a location known as the Arizona Gravel Pit, located in the far northeast corner of Boulder Basin. The aggregate was processed at an aggregate classification plant located in the center of Boulder Basin, midway between the Arizona Gravel Pit and the dam site. The gravel pit, aggregate plant, and dam were connected by a railroad and roadways. In just under three years this system produced all of the aggregate needed to make concrete used to construct Hoover Dam. It also produced smaller quantities of aggregate for purposes as diverse as sand for sandblasting steel and providing stone to riprap railroad grades. The subject of the present discourse is the Arizona Gravel Pit Road, a gravel road that connected the Arizona Gravel Pit and the aggregate classification plant.

Other than an abundance of bleak yet striking desert scenery, Boulder Basin held few attractions prior to dam construction. Those traveling up the Colorado River in the nineteenth and early twentieth centuries avoided the untenable terrain of Black Canyon by swinging far to the west, rejoining the Colorado River at Las Vegas Wash. This route bypassed Boulder Basin. A minor trail went down Hemenway Wash at the south end of Boulder basin, extending to the entrance to Black Canyon. From there it proceeded in a northerly direction (first heading northwest then northeast) for 4.2 mi, to where it intercepted the Las Vegas Wash Road. A sketch map prepared by Young in 1929[1] denotes the approximate route of the road, which was labeled alternately as the "Old Road" or as "Old Callville Road from Black Canyon." The Old Road is also portrayed on the St. Thomas 1:250,000 USGS quadrangle map. On this map the road is located closer to the river, passing east of what is now the Boulder Islands and west of Sentinel Island. Only the northern portion of this alignment corresponds with that shown on the sketch map prepared by Young.

One reason Hoover Dam was built in Black Canyon was because of its proximity to the railroad and its repair shops in Las Vegas. But this was still a long way from the construction site, and the site itself was spread over many square miles. Before they could build a dam, the Bureau of Reclamation and its contractors had to build a transportation system. Hoover Dam served as the focal point around which all construction-related transportation centered. The Six Companies Aggregate Classification Plant served as the center of the construction universe in Boulder Canyon. The three roads present in the Boulder Basin (Las Vegas Wash Road, Hemeneway Wash Road, and the Old Road) saw heavy used during the early days leading up to selection of the Hoover Dam site and the onset of construction. All were vastly improved and bladed to meet the much heavier traffic needs of the project.

---

[1] Young, Walker R., R. F. Walter, and Paul A. Jones. *Sand and Gravel for Construction of Boulder Canyon Dam.* 1929. On file at National Archives and Records Administration, Denver, RG115 Engineering and Research Center Project Reports, Box 85, BC-510.00-HD-29-04-04.

The two major dam-related facilities located in or near Boulder Basin were the Arizona Gravel Pit and the Aggregate Classification Plant. The classification plant was located a little more than 4 mi away from its major source of aggregate located on the Arizona side of the Colorado River. A road link between the two places was required to support construction and operation of the pit. Given that need, Six Companies vastly improved portions of two existing roads and constructed two new segments of road. At the southern end, a new segment of road left the Hemenway Wash Road along the western flank of the Boulder Islands ridge, very quickly passed alongside the Aggregate Classification Plant, and continued northeast to encounter the Colorado River. There it joined for a short time the Old Road before running into the much more heavily traveled Las Vegas Wash Road, which turned and continued northeast toward Callville. A bridge was built across the Colorado River, and a new segment of road allowed access to the Arizona Gravel Pit.

Six Companies upgraded existing and newly-constructed roads to the extent warranted by the amount of traffic. The Boulder Highway and Hemenway Wash Roads had such heavy traffic that they were paved. Heavy haulage to and from the Arizona Gravel Pit was taken care of by train, but there was still a certain amount of daily vehicular traffic carrying supplies, supervisors, inspectors, and crew back and forth. To accommodate this amount of traffic, the company bladed the Arizona Gravel Pit Road wide enough for two vehicles to pass. Since construction and maintenance of the railroad was carried out along the grade itself, the road did not closely follow the railroad, rather taking a more direct course across Boulder Basin.

The Arizona Gravel Pit Road departed from the Hemenway Wash Road just east of the ridge now known as the Boulder Islands. From here the road ran along the west side of the railroad line before crossing to the east side of the railroad just south of the Aggregate Classification Plant. Instead of going through the Aggregate Classification Plant, the road curved around the toe of the ridge before taking a long straight alignment to rejoin the railroad north of the Plant. From its intersection with the Six Companies, Inc. Railroad line to the Arizona Gravel Pit, the road trended northeast to shortcut a large curve in the railroad line. A short distance after rejoining the railroad, the historic mapping fails. The exact alignment of the road is not known between here and its connection with the Las Vegas Wash Road. The only first-hand description from the Arizona Gravel Pit found is as follows:

> The rough construction road parallels the railroad line for about 5 miles to a timber-pile trestle across the river. The road is not built for hauling, as transportation from pit to plant is by the railroad.... Out onto the railroad trestle the road leads across the river to the Arizona side.[2]

A Six Companies financial statement[3] notes that $432,000 was charged for the road to the Arizona Gravel Pit, which is an immensely inflated figure that should be discounted as a clerical error. More reasonable are data presented in a series of statements used for billings[4] [5]

---

[2] Engineering News-Record. "A Tale of Construction Marvels at Hoover Dam." April 21, 1932:572.

[3] Six Companies, Inc., *Statement of Six Companies, Inc.* Dec. 31, 1931, Schedule 20: Plant. On file at the Bancroft Library, 83/42c, Box 269 Folder 22 Plant 1931.

[4] Six companies, Inc. *Summary of Preparatory Expenses to March 31, 1932, Inclusive.* On file at National Archives and Records Administration, Denver, RG115 Colorado River Project, Entry 7 Correspondence, Box 244 214.131. 1932.

that indicate the road was built entirely in the period from October 1, 1931 to March 31, 1932 for a total cost of $2,854.50. The total amount allocated for building this road was $5,000.00.

The pile bridge to the Arizona Gravel Pit was dismantled late in July 1934 and shipped to Parker Dam, another Six Companies jobsite, in August. It was still in good condition when removed. Prior to taking down the bridge, the railroad tracks in and near the Arizona deposit were removed.[6] [7] Segments of the Arizona Gravel Pit Road were abandoned in place as railroad and gravel operations were terminated and facilities removed.[8]

Present Condition

When the Hoover Dam related gravel operation stopped in November 1934, the Arizona Gravel Pit Road was abandoned and eventually covered by Lake Mead. Researchers conducting underwater remote operated vehicle inspections, side-scanning sonar sweeps, and bathymetric mapping of the area were amazed to find that segments of this bladed ribbon across the desert had survived intact. Rather than burying it beneath layers of silt or destroying it by wave action, Lake Mead had protected portions of this unassuming but critical portion of the great system of works needed for construction of Hoover Dam.

Currently, the Arizona Gravel Pit Road is completely submerged beneath Lake Mead. When identified as part of underwater archaeological studies it was assigned site number 26CK7254. Within the surveyed area, the 15 ft wide road extended from southeast to northwest for a distance of 1,600 ft. Based on an examination of available historic maps, the road location can be plotted on modern maps quite accurately, except for the mile of road immediately south of where it meets the Las Vegas Wash Road.

Twichell et al.[9] have reported on a multi-year geophysical mapping program designed to locate and estimate the depth of sediment that has accumulated in Lake Mead since the onset of impoundment. Examination of mapping provided by Twichell et al. suggests that portions of the Gravel Pit Road located closest to the Colorado River are now covered by 1 to 15 m of post-inundation sediment. Only as the road climbs up out of the immediate flood plain (about 1 mile south of Las Vegas Wash) would it reappear. From there south to the Hemenway Wash Road, the road corridor does not appear to contain substantial deposits of post-inundation sediment.

---

[5] Six Companies, Inc. *Summary of Preparatory Expenses to November 22, 1932, Inclusive.* On file at National Archives and Records Administration, Denver, RG115 Colorado River Project, Entry 7 Correspondence, Box 244 214.131. 1932.

[6] Heinman, Ed. *Six Companies Inc. Plant and Equipment.* On file at National Archives and Records Administration, Denver, RG115 Engineering and Research Center Project Reports, Box 107, BC-562.00-36-12-29. 1936.

[7] Bureau of Reclamation. *Annual Project History: Boulder Canyon Project, Hoover Dam.* On file at Bureau of Reclamation, Hoover Dam Archives. 1934.

[8] Bureau of Reclamation. Concrete Manufacture, Handling, and Control. *Boulder Canyon Project Final Reports* Part IV Design and Construction, Bulletin 4. On file at Bureau of Reclamation, Denver. 1947.

[9] Twichell, David C., VeeAnn A. Cross, and Stephen D. Belew. Mapping the Floor of Lake Mead (Nevada and Arizona): Preliminary Discussion and GIS Data Release. U.S. Geological Survey Open-File Report 03-320. 2003.

This assumption was substantiated as a result of underwater remote sensing along the recorded segment of roadway located north of the Aggregate Classification Plant. In that area, the road is very evident and retains considerable integrity. Edges of the roadway are clearly discernable and the road surface does not appear to have accumulated sediments or suffered sloughing or cutting. It is reasonable to anticipate that if further underwater studies were carried out, that the road could be followed from a point about 1 mile south of its intersection with the Las Vegas Wash road at the north end, to the Hemenway Wash Road at its south end. The integrity of the examined segment would appear to be indicative of that portion of the road that has not been buried. Aside from the fact that it is now under water, that portion of the roadway appears to retain its integrity of location, design, materials, and association. As a result, it seems reasonable to conclude that the road from a point about 1 mile south of Las Vegas Wash to the Hemenway Wash Road is also likely to exhibit good to exceptional integrity. Segments of the road extending north from that point to the trestle, and from the trestle to the Arizona Gravel Pit are now buried by post-inundation sediment.

II. HISTORICAL CONTEXT

In the last half of the nineteenth century, as American settlers moved west of the 100th meridian in ever-increasing numbers, they encountered a lack of water in a region characterized by Walter Prescott Webb[10] as "The Great American Desert." These conditions often defeated efforts to farm in a manner that worked well farther east. This problem was formally recognized in 1878 by John Wesley Powell[11] when he argued for a major reworking of the legal basis for obtaining ownership of the land due to lack of water. By 1900, despite the best efforts of the General Land Office to place the public domain into the hands of productive citizen farmers, over a third of the country remained vacant.

To many, managing the limited supply of water in the West was an obvious task for the federal government. It became a central aspect of demands for increased government involvement in local affairs that was to characterize Progressive Era politics toward the end of the century.[12] Under the general rubric of reclamation, supporters of major irrigation works often campaigned for their favorite projects with messianic fervor, arguing for nothing less than "the conquest of arid America."[13] At the urging of Theodore Roosevelt and many interest groups, the Reclamation Service was created in 1902 (it became the Bureau of Reclamation in 1923, specifically dedicated to constructing large-scale irrigation projects.[14] [15]

---

[10] Webb, Walter Prescott. "The American West, Perpetual Mirage." *Harpers,* May, 1957.
[11] Powell, John Wesley. *Report on the Lands of the Arid Region of the United States*, 1878. Reprint edited by Wallace Stegner, Cambridge, Massachusetts, 1962.
[12] Hayes, Samuel P. Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920. Harvard University Press, Cambridge, 1959.
[13] Smythe, William E. *The Conquest of Arid America.* McMillian, New York, 1899.
[14] Frederick, Kenneth D. Water Resources: Increasing Demand and Scarce Supplies, In, *America's Renewable Resources: Historical Trends and Current Challenges*, edited by K. D. Frederick and R. A. Sedjo, pp. 23-80. Resources for the Future, Washington, D. C., 1991.
[15] Newell, Frederick Haynes. *Irrigation in the United States.* Thomas Y. Crowell, New York, 1906.

From the end of World War I until Franklin Roosevelt's election in 1932, conservative Republicans took a more cautious approach to conservation than had been advocated by the earlier Progressives. The Boulder Canyon Project was the one great exception, and its success was due mainly to another aspect of dam construction and use – hydroelectric power.

By the late nineteenth century electrical power was leaving the laboratories and beginning its explosive expansion for utilitarian purposes. Water power was an obvious means of turning the necessary generators, with the first two placed in operation in 1882. By the first decades of the twentieth century, it was obvious that any area without abundant and inexpensive electrical power was doomed to industrial and economic stagnation. Developers centered in the Los Angeles area of Southern California recognized this problem and lobbied hard for a source of hydroelectric power from the Colorado River, along with water for irrigation and urban purposes. The critical part of the Boulder Canyon Project Act of 1928 that gained conservative support was the provision that the hydroelectric power generated by Boulder Dam would be sold and revenue would be used to repay the government's construction costs. This formula became the model for many post-World War I projects.[16]

Some 70 possible dam and reservoir sites along the Colorado were investigated beginning in 1904. By 1919, attention focused on the Black Canyon and Boulder Canyon sites. Simultaneously, investigations were in progress regarding the feasibility of a major canal (the All-American Canal) from the Colorado to the Imperial Valley. These preliminary studies were used by Reclamation to generate a series of technical reports to Congress starting in 1922. By 1928, Reclamation determined that from an engineering perspective the Black Canyon site was the best place for a dam.[17]

After extensive Congressional wrangling, President Hoover signed the Boulder Canyon Project Act, which authorized $165 million to construct Boulder Dam and the All-American Canal, on June 25, 1929. Major components of the water control and power generation system for the lower Colorado River ultimately included the dam, the impounded reservoir that would become Lake Mead, Parker Dam, the Colorado River Aqueduct, the All American Canal and Coachella Branch Canal, Imperial Dam, Laguna Dam, and a power transmission line from Los Angeles to the Black Canyon construction site. On July 3, 1930, Congress appropriated the first installment of the total $327 million in contracts for the Boulder Canyon Project.

Walker Young, an engineer with Reclamation, was put in charge of coordinating and monitoring contractors hired to build the project. Reclamation established a detailed scope of work for potential contractors to bid on.[18] On March 4, 1931, Six Companies, Inc., was awarded the contract for construction of Hoover Dam for $48,890,995.50.[19] Construction

---

[16] Frederick, Kenneth D. Ibid.
[17] Bureau of Reclamation. *The Story of Hoover Dam.* Government Printing Office, Washington, D.C., 1976, pp. 8-12.
[18] Bureau of Reclamation. Specifications, Schedule, and Drawings: Hoover Dam, Power Plant, and Appurtenant Works, Boulder Canyon Project Arizona-California-Nevada. On file at Bureau of Reclamation, Hoover Dam Archives, Specifications No. 519. 1930.
[19] Vivian, C.H. "Construction of the Hoover Dam." in *The Story of the Hoover Dam* pp. 25-29. Reprinted from *Compressed Air Magazine*, 1931-1935. Nevada Publications, Las Vegas, Nevada, 25.

formally began on September 17, 1930.[20] This was the largest contract ever let by the federal government up to that date.

Six Companies was actually a consortium of seven companies incorporated on February 18, 1931, in Wilmington, Delaware, specifically to meet stringent demands of the project. The combination of companies was needed to pool sufficient capital to raise the immense -- and for the time unprecedented -- completion bond required by the government. Utah Construction Company of Ogden, Utah, had experience in railroad, irrigation, and reclamation construction. The Pacific Bridge Company of Portland, Oregon, worked mainly in bridge building and underwater foundations. W.A. Bechtel Company of San Francisco, California, worked in railroad, dam, and general construction projects. Kaiser Paving Company, Ltd., of Oakland, California, had extensive experience in paving and associated aggregate operations. MacDonald & Kahn Company of Los Angeles, California, was a building contractor. The Morrison-Knudsen Company of Boise, Idaho, built roads, railroads, dams, and miscellaneous other structures. The J.F. Shea Company of Portland, Oregon, specialized in tunneling.

Construction of Hoover Dam began on April 1, 1931 as workers called "high-scalers" began blasting loose rock off cliff faces using jackhammers, pneumatic drills, and dynamite. Others were laying railroad tracks so that gravel from the Aggregate Classification Plant could be carried to two concrete-mixing facilities being built at the dam site. On February 1, 1935, workers used a steel bulkhead to plug Diversion Tunnel Number 4, and the Colorado River began to impound behind the dam. Six Companies completed concrete placement in the dam on May 29, 1935 and all features were completed by March 1, 1936 at which time Interior Secretary Ickes formally accepted the dam on behalf of the government. President Franklin D. Roosevelt presided over the dedication ceremony held on September 30, 1935. Beginning in 1937 the powerhouse began generation and transmission of hydroelectric power.

The engineering and construction of Hoover Dam was a tremendous and technologically-sophisticated feat. Up to 5,200 workers were employed at the peak of construction. They worked 24 hours a day, seven days a week. Working conditions were often deplorable. The dam was 726 ft high, 660 ft wide at its base, and 45 ft wide at its crest. At the time of its completion, the project resulted in the largest human-made reservoir in the world.

III. PROJECT DESCRIPTION

Highly treated municipal wastewater (effluent) in the Las Vegas Valley is currently discharged from regional wastewater treatment plants into the Las Vegas Wash, which flows into the Las Vegas Bay of Lake Mead. Treated wastewater has been discharged in this manner since 1956. The Las Vegas Wash is a tributary to the Colorado River, and the Las Vegas Bay and Lake Mead are part of the Colorado River System. The quantity of effluent treated and discharged from the Las Vegas Valley will increase as the population increases.

---

[20] Stevens, Joseph E. *Hoover Dam: An American Adventure.* University of Oklahoma Press. Norman, Oklahoma, 1988, 32-33.

The Clean Water Coalition (CWC) is comprised of four agencies currently responsible for wastewater treatment in the Las Vegas Valley: the City of Las Vegas, the City of North Las Vegas, the City of Henderson, and the Clark County Water Reclamation District. The CWC proposes to implement the Systems Conveyance and Operations Program (SCOP). The SCOP will provide an alternate location for effluent currently discharged to Lake Mead through the Las Vegas Wash. The SCOP includes a combination of plant optimization, increased treatment processing, collection of treated effluent from the various treatment facilities, and a system of pipelines and tunnels that would discharge highly treated effluent to Lake Mead near the Boulder Islands, thereby obtaining better dispersion of the treated wastewater. Once implemented, the majority of flows would bypass the Las Vegas Wash.

The SCOP requires constructing a pipeline from the Las Vegas Valley into the Boulder Basin of Lake Mead. The pipeline is broken into two main segments: the Effluent Interceptor (EI) which connects various water treatment facilities in the Las Vegas Valley, and the Boulder Islands North Lake Conveyance System (LCS) which carries the treated effluent into Lake Mead. A majority of the EI will be installed using cut-and-cover trench techniques. A portion of Reach 3 of the EI will be placed in a tunnel located 45 to 90 feet (ft) below ground surface.

The Boulder Islands North LCS will be placed in a tunnel 200 ft below ground surface running to Lake Mead, and will terminate at a Hydroelectric/Pressure Regulating Station (HPRS) located northwest of Boulder Harbor above high water. Five pipes will exit the HPRS, extend into Lake Mead approximately 18,000 ft and terminate at an elevation of approximately 850 ft. The pipes will be 2 ft apart and each pipe will have an inside diameter of 63 in. The total width of the pipe configuration will be 55 ft. The pipe configuration will be placed in a trench and covered with sediment to an elevation of 1,000 ft to protect the pipes during periods of low water. At an elevation of 1,000 ft the 5 pipelines will transition to subaqueous pipelines that will be installed on pylons anchored to the bottom of Lake Mead. Each pipeline will terminate in a single port diffuser. A pile foundation inserted into the ground at an elevation of approximately 850 ft will support each diffuser.

Archaeological investigations were conducted as part of the planning process[21] resulting in identification of the Arizona Gravel Pit Road as site 26Ck7254. Construction of pipelines associated with the Boulder Islands North LCS will impact portions of the Arizona Gravel Pit Road. A compilation of historical documentation regarding the road was carried out as a treatment activity.[22] Information contained herein is drawn from this compilation. It should be noted that other elements of the infrastructure associated with construction of Hoover Dam have been documented as part of the same treatment process. They include the Aggregate Classification Plant (HAER No. NV-43) and the Six Companies Railroad (HAER No. NV-44).

---

[21] Harper, C., S. Eskenazi, H. Roberts, R. Ahlstrom, R. Gearnart, and D. Jones. Archaeological Inventory for the Systems Conveyance and Operations Program, Lake Conveyance System Pipeline, Clark County, Nevada. HRA, Inc. archaeological report 01-15B, Las Vegas, Nevada, 2005.

[22] Reno, Ron, and Charles Zeier. Six Companies Railroad, Aggregate Classification Plant, and Construction Roads Beneath Lake Mead, Heritage Resources Associated with the Systems Conveyance and Operations Program, Clark County, Nevada. Report prepared by Zeier & Associates, Clinton, Tennessee. 2008

IV. BIBLIOGRAPHY

Archival Sources

National Archives – Denver

Bureau of Reclamation Archives
- Lower Colorado Region Engineering Archive
- Lower Colorado Region Photo Archive
- Hoover Dam Archive
- Denver Design Archive

Special Collections, University of Nevada – Las Vegas

Nevada State Historical Society – Las Vegas

Nevada State Library – Carson City

Nevada State Historic Preservation Office

Bancroft Library, University of California – Berkeley
- Six Companies Archive

University of Colorado – Boulder
- Special Collections and Archive

Stewart Library, Weber State University
- Utah Construction Company Archive
- W. H. Wattis Hoover Dam Photo Archive

Denver Public Library – Western History Center

Boulder City/Hoover Dam Museum

Newspapers Consulted

Las Vegas Evening Review Journal
Los Angeles Times

Books, Articles, and Reports

Bureau of Reclamation. *Specifications, Schedule, and Drawings: Hoover Dam, Power Plant, and Appurtenant Works, Boulder Canyon Project Arizona-California-Nevada.* On file at Bureau of Reclamation, Hoover Dam Archives, Specifications No. 519. 1930.

Bureau of Reclamation. *Annual Project History: Boulder Canyon Project, Hoover Dam.* On file at Bureau of Reclamation, Hoover Dam Archives. 1934.

Bureau of Reclamation. Concrete Manufacture, Handling, and Control. *Boulder Canyon Project Final Reports* Part IV Design and Construction, Bulletin 4. On file at Bureau of Reclamation, Denver. 1947.

Bureau of Reclamation. *The Story of Hoover Dam.* Government Printing Office, Washington, D.C., 1976.

Engineering News-Record. "A Tale of Construction Marvels at Hoover Dam." April 21, 1932:570-574.

Frederick, Kenneth D. Water Resources: Increasing Demand and Scarce Supplies, In, *America's Renewable Resources: Historical Trends and Current Challenges*, edited by K. D. Frederick and R. A. Sedjo, pp. 23-80. Resources for the Future, Washington, D. C., 1991.

Harper, C., S. Eskenazi, H. Roberts, R. Ahlstrom, R. Gearnart, and D. Jones. Archaeological Inventory for the Systems Conveyance and Operations Program, Lake Conveyance System Pipeline, Clark County, Nevada. HRA, Inc. archaeological report 01-15B, Las Vegas, Nevada, 2005.

Hayes, Samuel P. *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920*. Harvard University Press, Cambridge, 1959.

Heinman, Ed. *Six Companies Inc. Plant and Equipment.* On file at National Archives and Records Administration, Denver, RG115 Engineering and Research Center Project Reports, Box 107, BC-562.00-36-12-29. 1936.

Newell, Frederick Haynes. *Irrigation in the United States.* Thomas Y. Crowell, New York, 1906.

Powell, John Wesley. *Report on the Lands of the Arid Region of the United States.* 1962 reprint edited by Wallace Stegner, Cambridge, Massachusetts, 1878.

Reno, Ron, and Charles Zeier. Six Companies Railroad, Aggregate Classification Plant, and Construction Roads Beneath Lake Mead, Heritage Resources Associated with the Systems Conveyance and Operations Program, Clark County, Nevada. Report prepared by Zeier & Associates, Clinton, Tennessee. 2008

Six Companies, Inc., *Statement of Six Companies, Inc.* Dec. 31, 1931, Schedule 20: Plant. On file at the Bancroft Library, 83/42c, Box 269 Folder 22 Plant 1931.

Six Companies, Inc. *Summary of Preparatory Expenses to March 31, 1932, Inclusive.* On file at National Archives and Records Administration, Denver, RG115 Colorado River Project, Entry 7 Correspondence, Box 244 214.131. 1932.

Smythe, William E. *The Conquest of Arid America.* McMillian, New York, 1899.

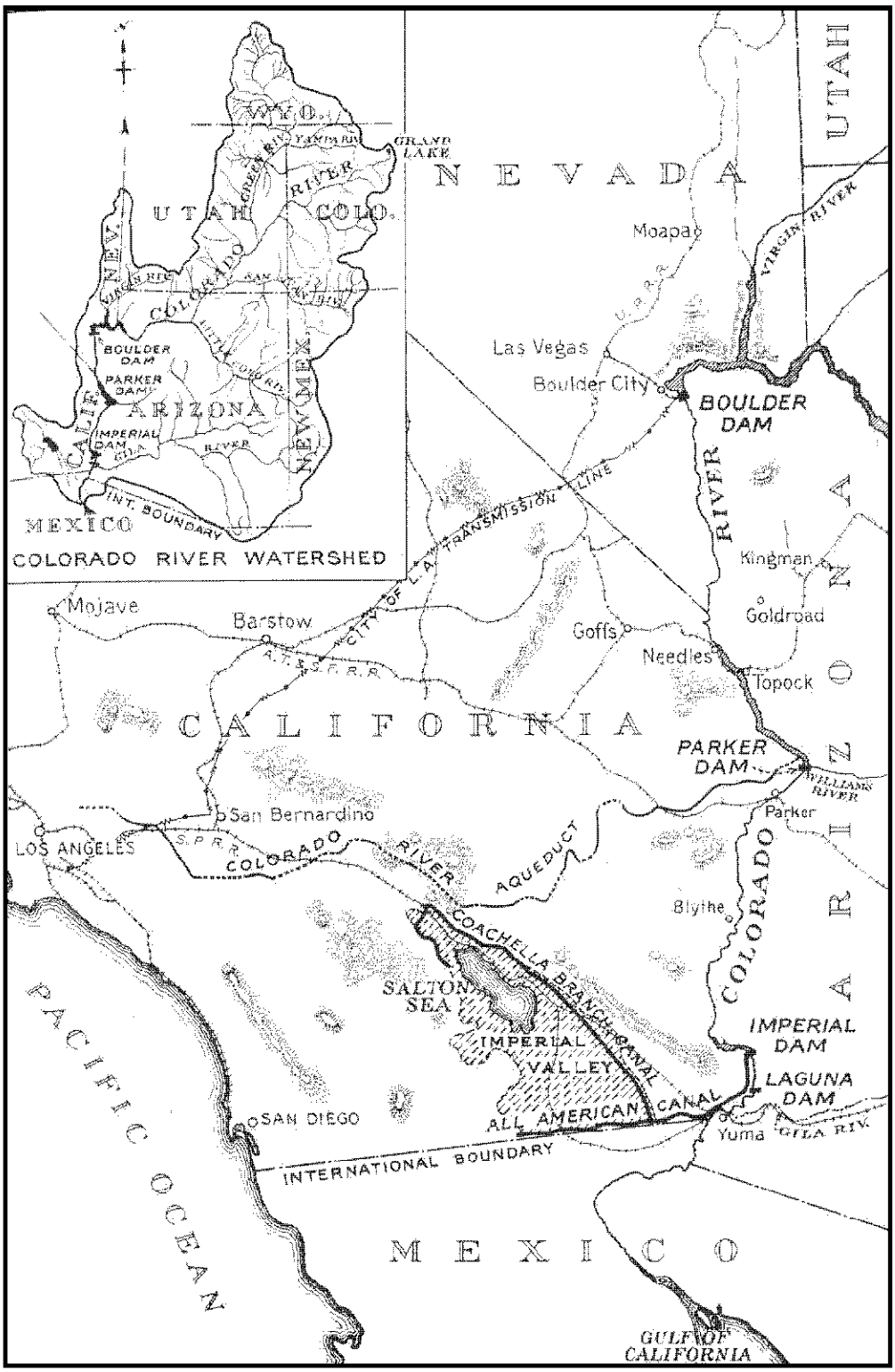
Stevens, Joseph E. *Hoover Dam: An American Adventure.* University of Oklahoma Press. Norman, Oklahoma, 1988.

Twichell, David C., VeeAnn A. Cross, and Stephen D. Belew. Mapping the Floor of Lake Mead (Nevada and Arizona): Preliminary Discussion and GIS Data Release. U.S. Geological Survey Open-File Report 03-320. 2003.

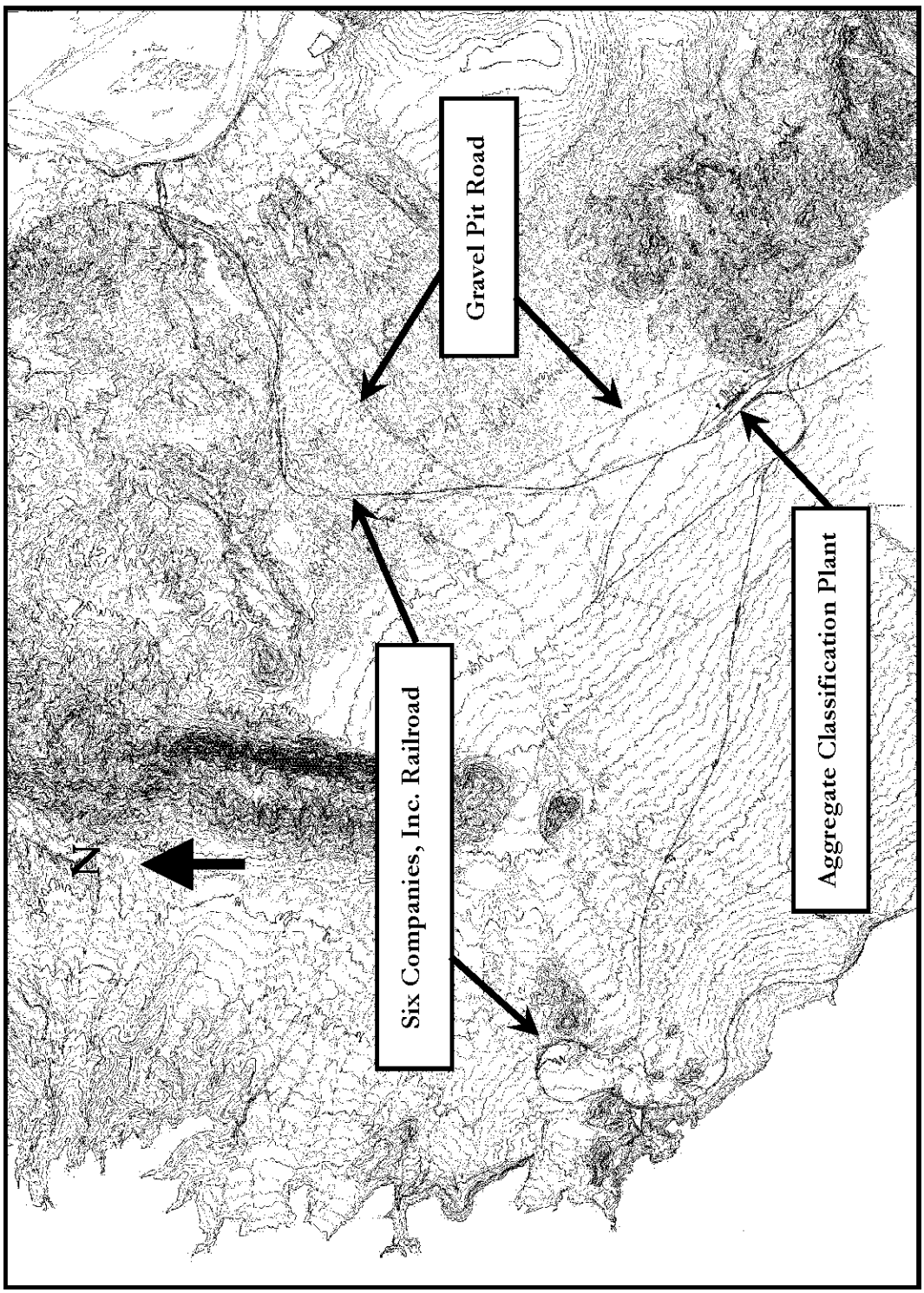
Vivian, C.H. "Construction of the Hoover Dam." in *The Story of the Hoover Dam* pp. 25-29. Reprinted from *Compressed Air Magazine*, 1931-1935. Nevada Publications, Las Vegas, Nevada.

Webb, Walter Prescott. "The American West, Perpetual Mirage." *Harpers,* May, 1957.

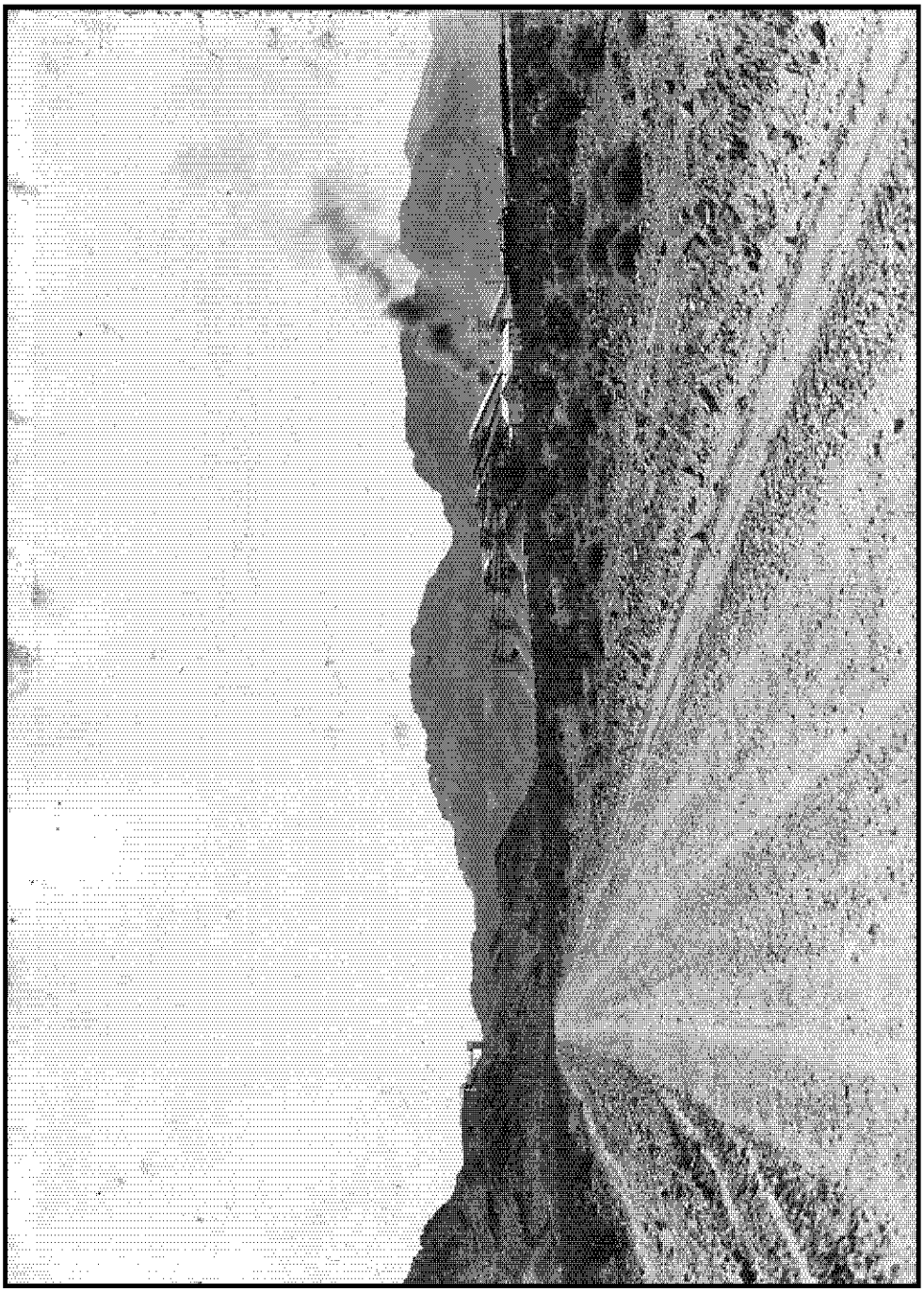
Young, Walker R., R. F. Walter, and Paul A. Jones. *Sand and Gravel for Construction of Boulder Canyon Dam*. On file at National Archives and Records Administration, Denver, RG115 Engineering and Research Center Project Reports, Box 85, BC-510.00-HD-29-04-04. 1929.



Location map for the Boulder Canyon Project.
Reprinted from Bureau of Reclamation (1947:v)



Boulder Basin topographic map (no scale).
Courtesy Lake Mead NRA



Segment of the Arizona Gravel Pit Road facing southeast, 4/1/1932. The Aggregate Classification Plant is in the background to the right and the water clarifier is on the hill directly above the end of the road. Courtesy Bureau of Reclamation (Wash-No-1129).